FIG.1

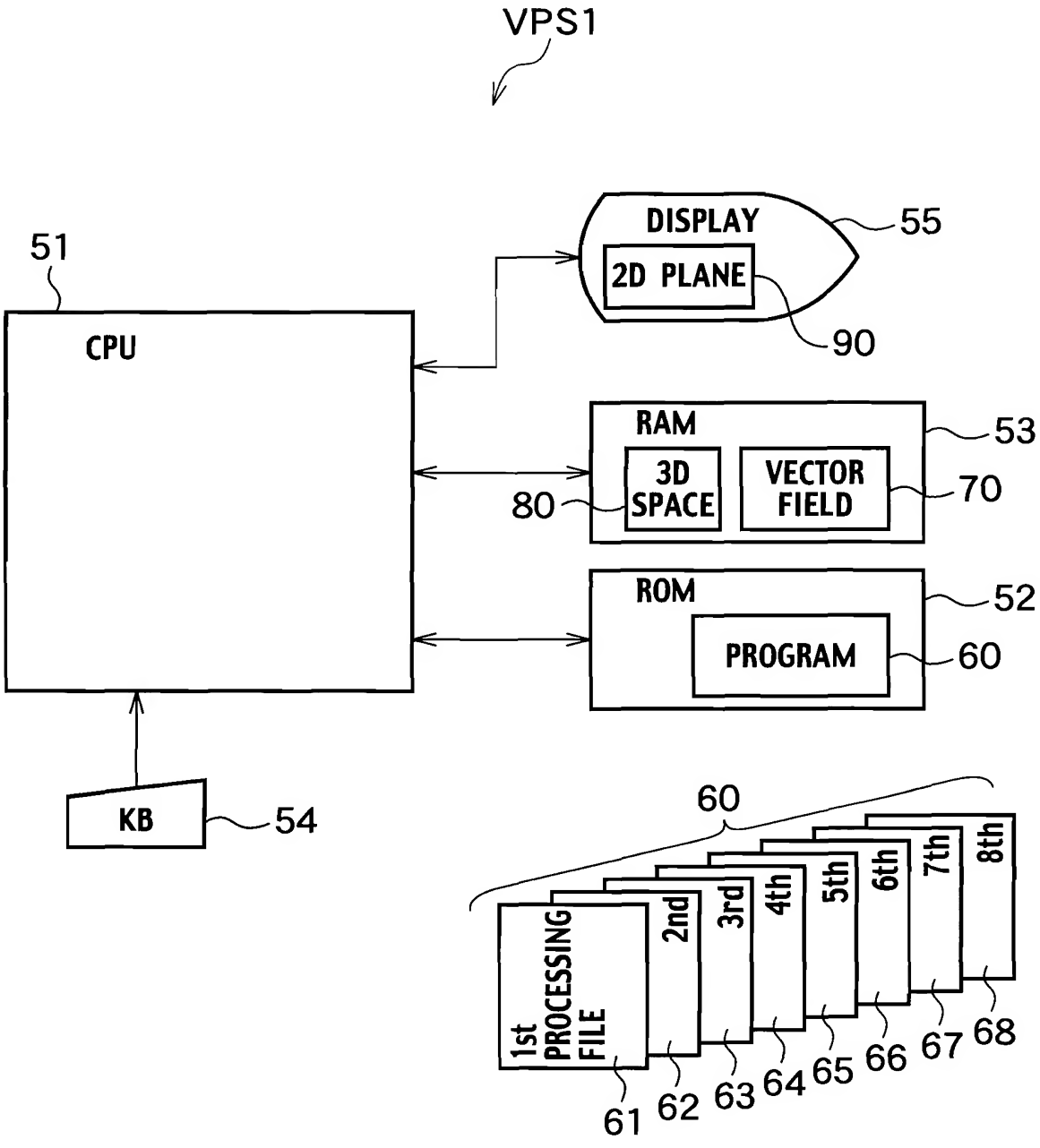

VPS1
51
CPU
DISPLAY
55
2D PLANE
90
RAM
53
3D SPACE
80
VECTOR FIELD
70
ROM
52
PROGRAM
60
KB
54
60
1st PROCESSING FILE
2nd
3rd
4th
5th
6th
7th
8th
61
62
63
64
65
66
67
68

FIG.2

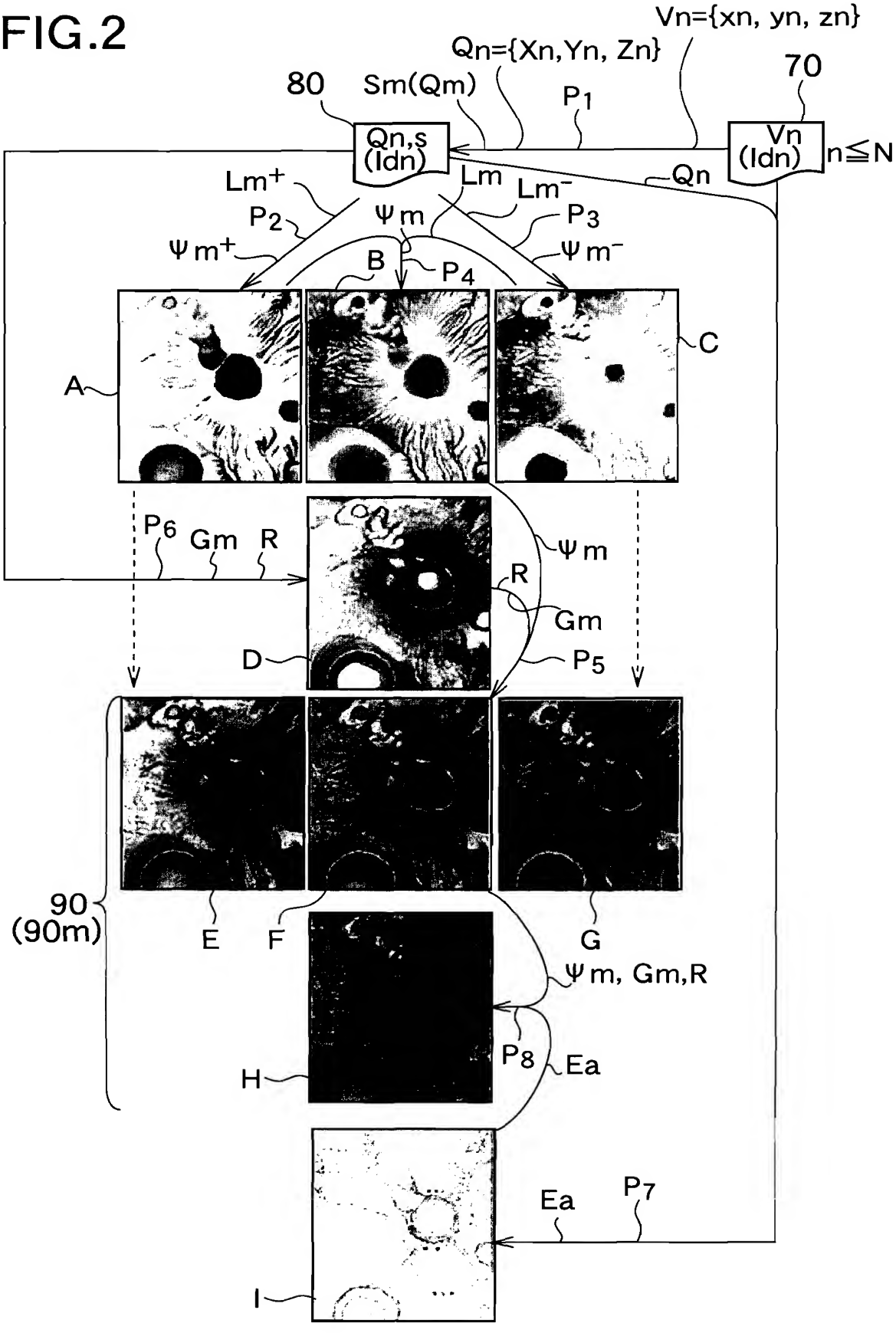

Vn={xn, yn, zn}
Qn={Xn,Yn, Zn}
70
80
Sm(Qm)
P1
Qn,s
(Idn)
Vn
(Idn)
n≦N
Qn
Lm+
Lm
Lm−
P2
Ψm
P3
Ψm+
B
P4
Ψm−
A
C
P6
Gm
R
Ψm
R
Gm
D
P5
90
(90m)
E
F
G
Ψm, Gm,R
H
P8
Ea
Ea
P7
I

FIG.3

FIG.4

FIG.5

FIG.6

FIG.7

FIG.8

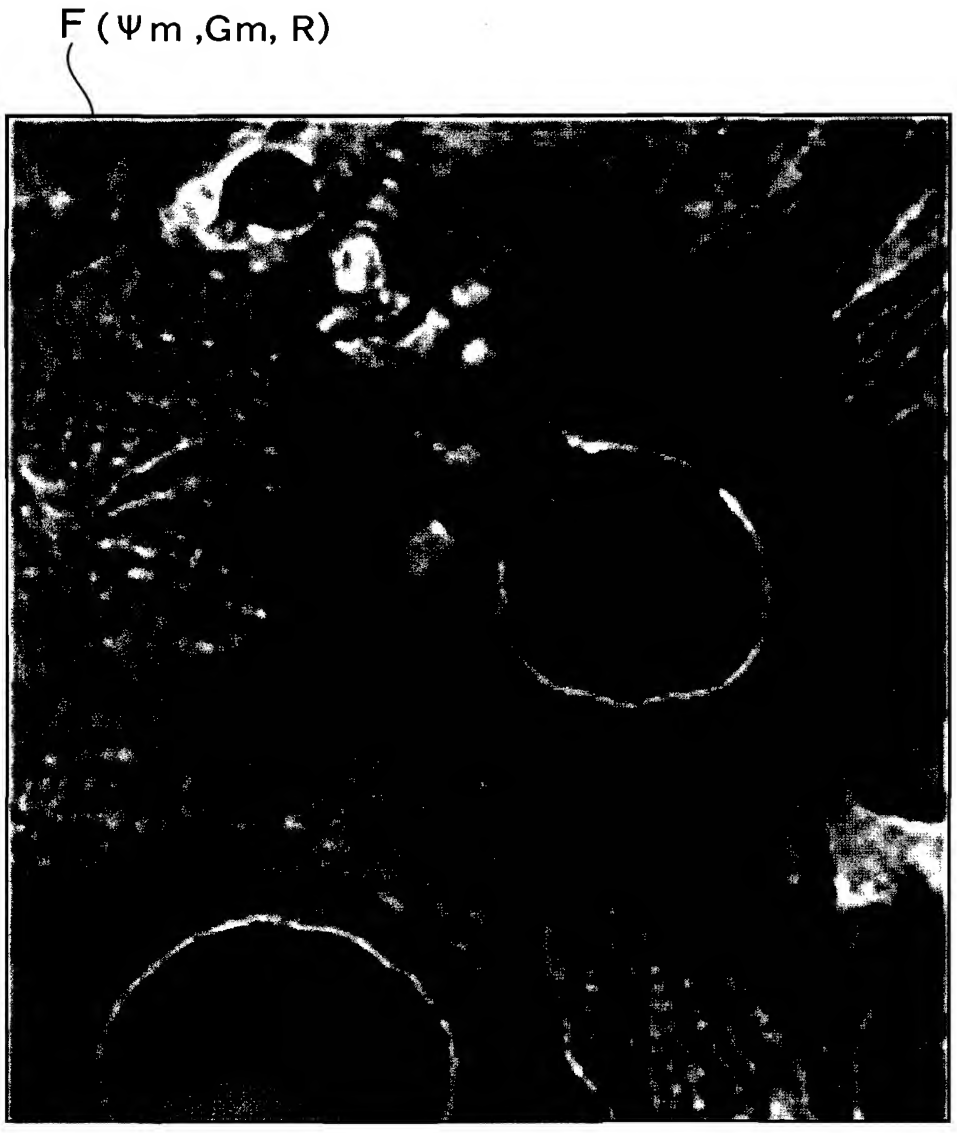


FIG.9

FIG.10

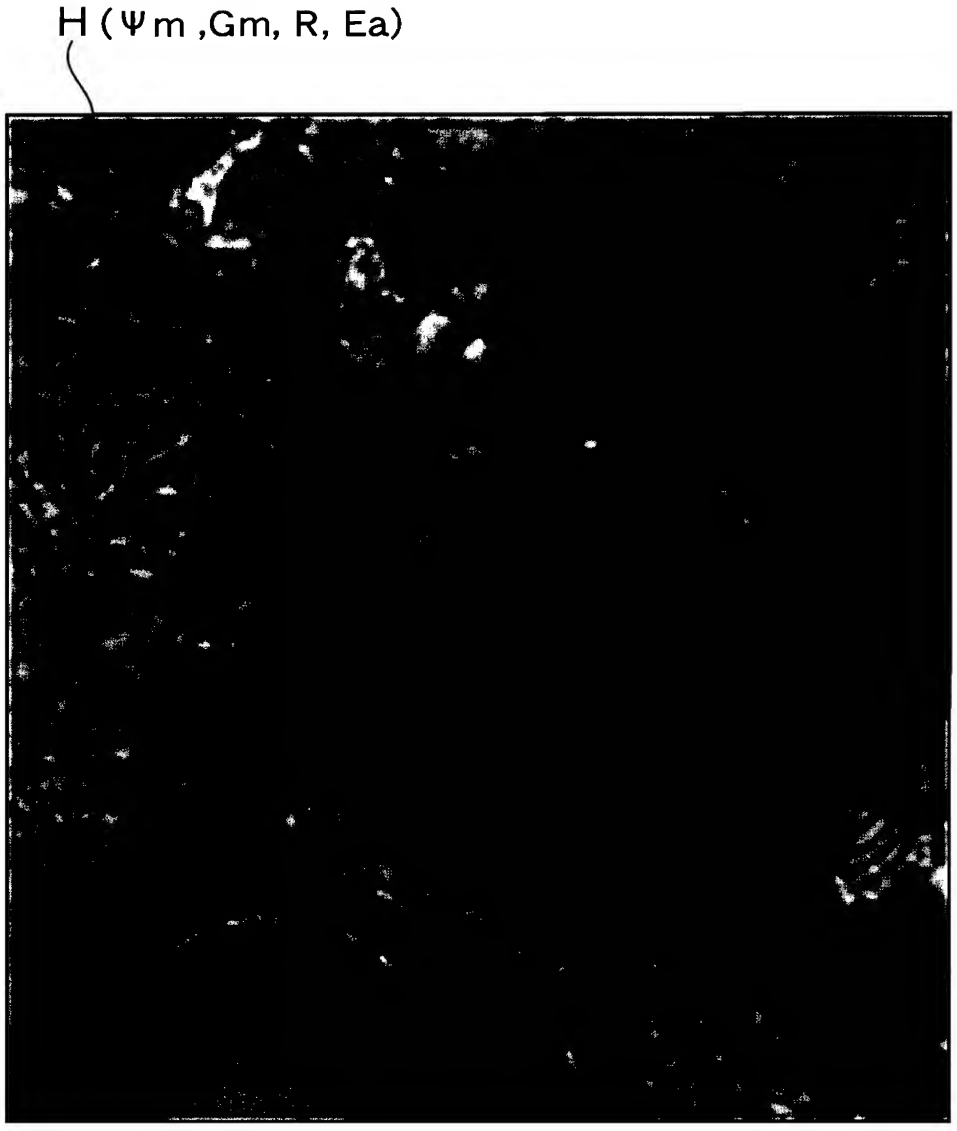


FIG.11

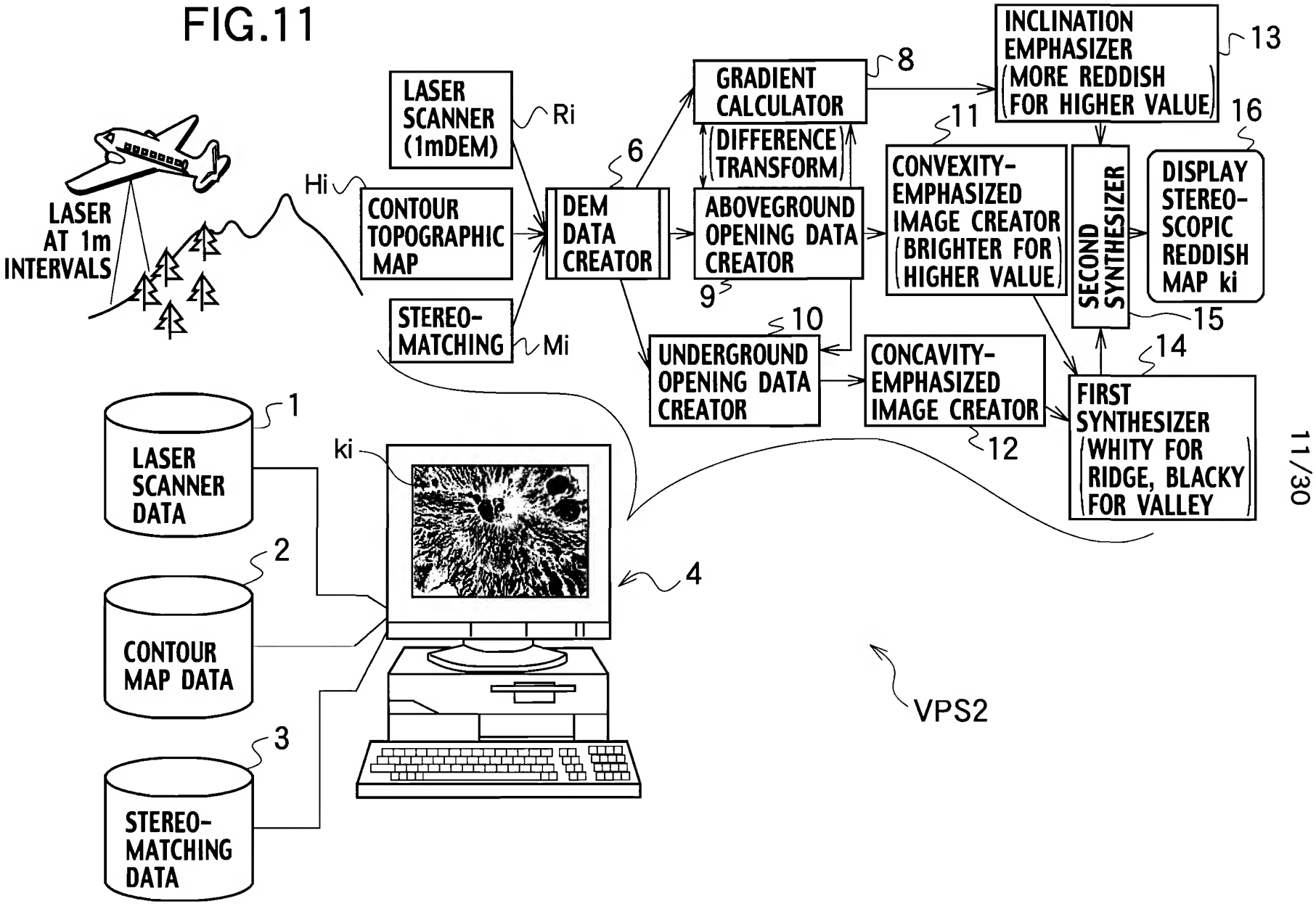

LASER AT 1m INTERVALS
LASER SCANNER (1mDEM)
Ri
Hi
CONTOUR TOPOGRAPHIC MAP
STEREO-MATCHING
Mi
DEM DATA CREATOR
6
GRADIENT CALCULATOR
8
DIFFERENCE TRANSFORM
ABOVEGROUND OPENING DATA CREATOR
9
UNDERGROUND OPENING DATA CREATOR
10
INCLINATION EMPHASIZER (MORE REDDISH FOR HIGHER VALUE)
13
11
CONVEXITY-EMPHASIZED IMAGE CREATOR (BRIGHTER FOR HIGHER VALUE)
CONCAVITY-EMPHASIZED IMAGE CREATOR
12
SECOND SYNTHESIZER
16
DISPLAY STEREO-SCOPIC REDDISH MAP ki
15
14
FIRST SYNTHESIZER (WHITY FOR RIDGE, BLACKY FOR VALLEY
LASER SCANNER DATA
1
CONTOUR MAP DATA
2
STEREO-MATCHING DATA
3
ki
4
VPS2

FIG.12

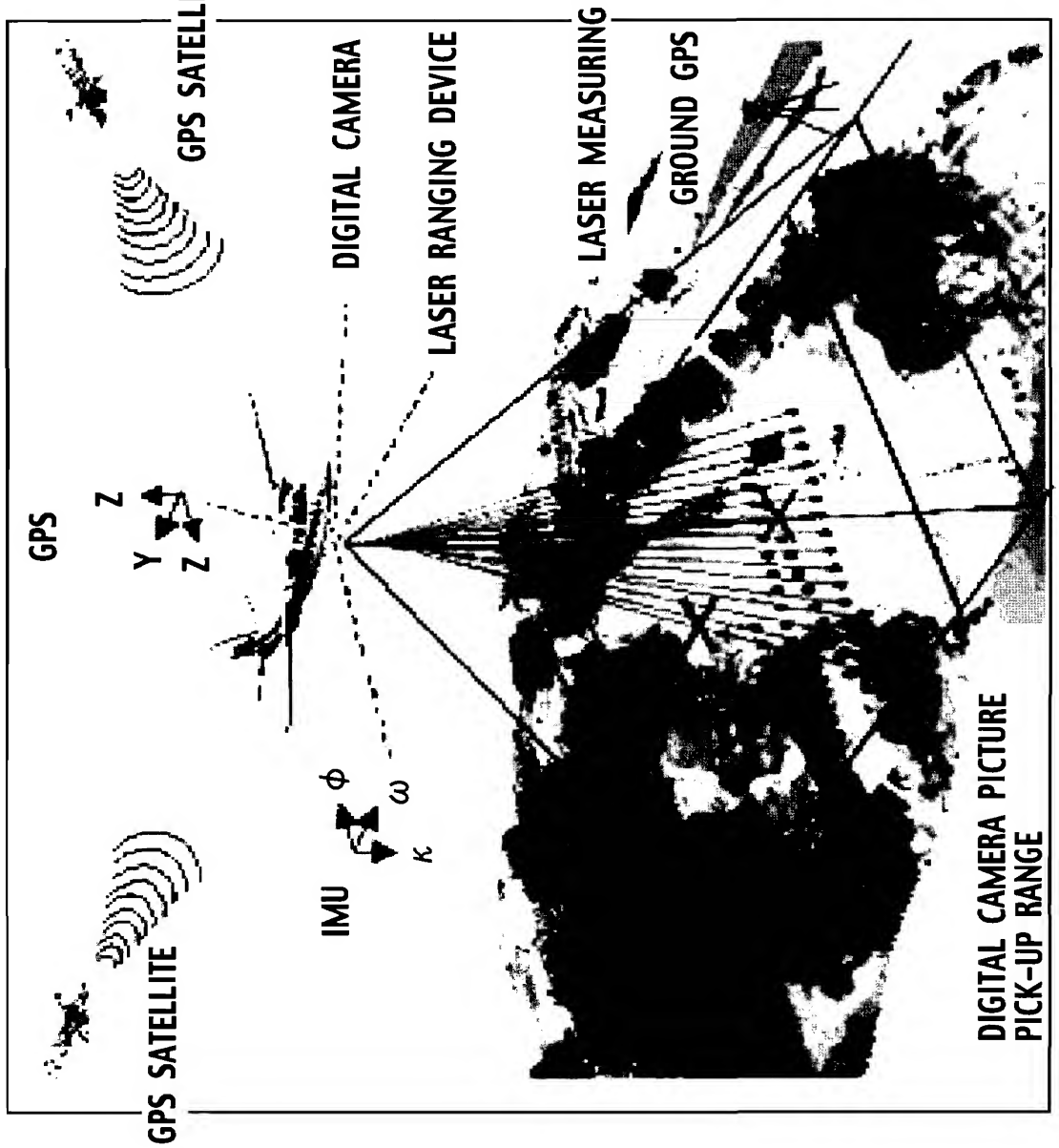
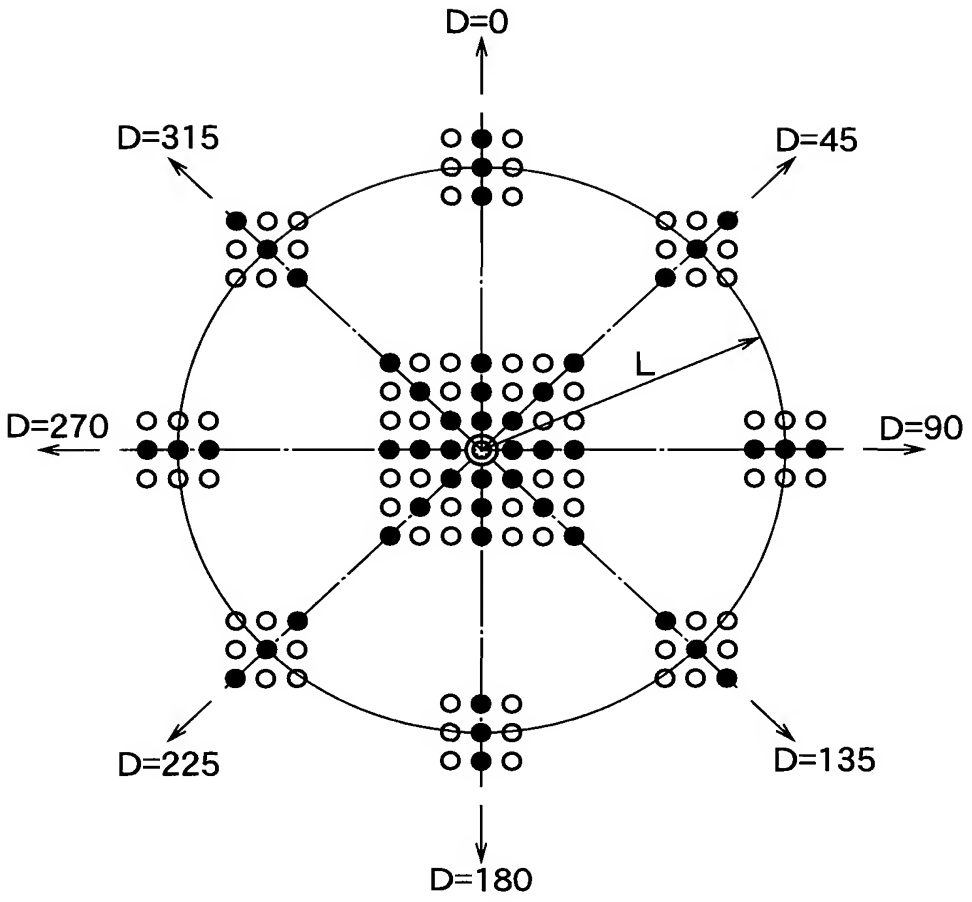
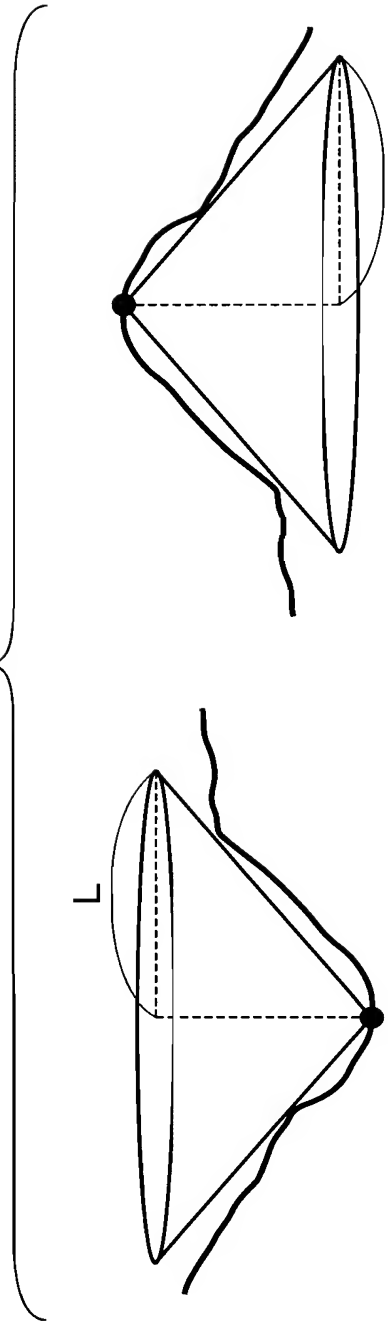

GPS
Z
Y
Z
GPS SATELLITE
DIGITAL CAMERA
LASER RANGING DEVICE
LASER MEASURING POINT
GROUND GPS
IMU
φ
ω
κ
GPS SATELLITE
DIGITAL CAMERA PICTURE
PICK-UP RANGE

FIG.13



CONDITION OF ARRANGEMENT OF SAMPLE POINTS ABOUT FOCUSED SAMPLE POINT (◎-MARK) IN UTM-DEM
●-MARKS DENOTE SAMPLE POINTS IN EIGHT AZIMUTHS, ○-MARKS DENOTE OTHER SAMPLE POINTS

FIG.14



(ABOVEGROUND OPENING)

(UNDERGROUND OPENING)

OPENINGS AT FOCUSED SAMPLE POINT (●-MARK)

FIG.15

: ABOVEGROUND OPENING AND UNDERGROUND OPENING OF FOCUSED SAMPLE POINT (●-MARK) IN BASIC GEOGRAPHICAL FEATURES

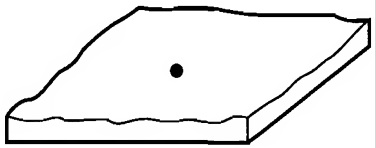
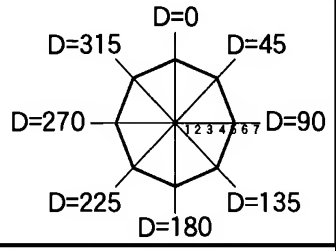
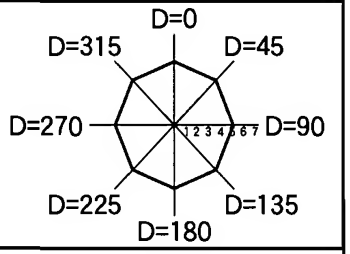
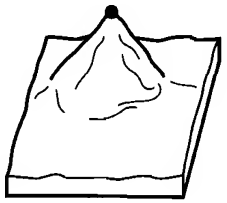
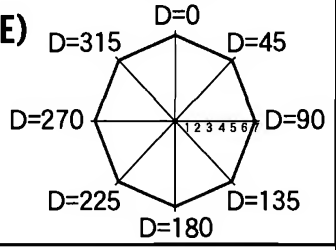
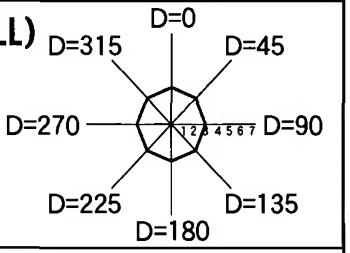
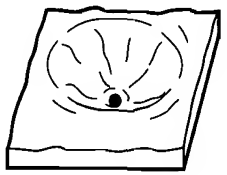
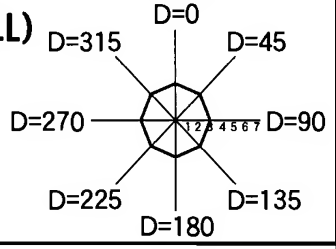
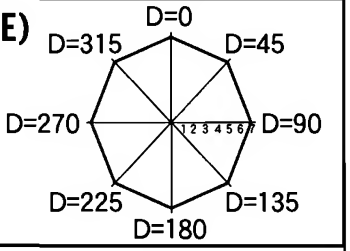
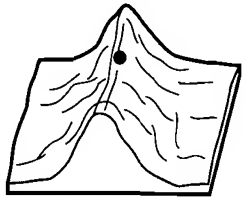
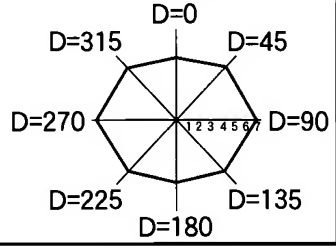
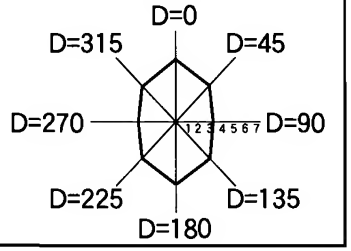
	BASIC GEOGRAPHICAL FEATURES		ABOVEGROUND OPENING	UNDERGROUND OPENING
1	FLAT TERRAIN		(MEDIUM) 	(MEDIUM) 
2	SUMMIT		(VERY LARGE) 	(VERY SMALL) 
3	CONCAVE TERRAIN		(VERY SMALL) 	(VERY LARGE) 
4	RIDGE EXTENDING NORTH-TO-SOUTH		(LARGE) 	(SMALL) 

FIG.16

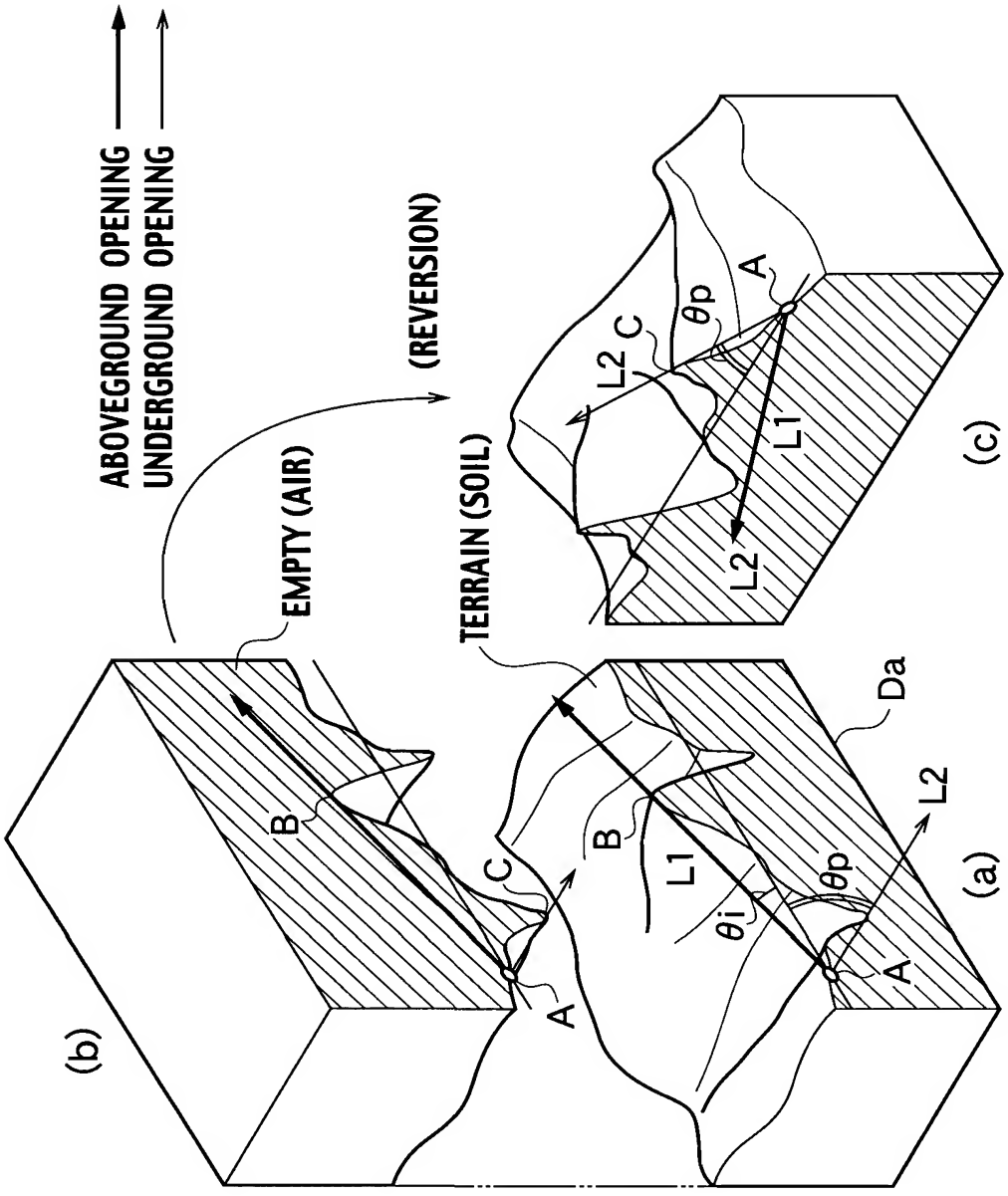
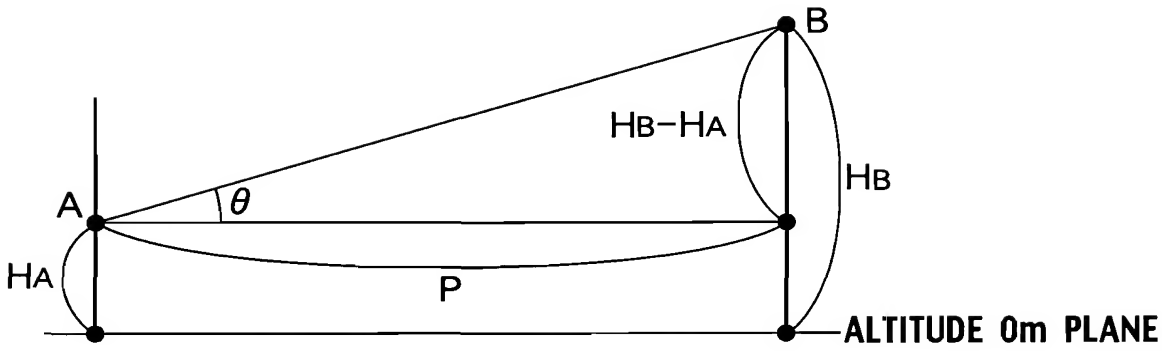

ABOVEGROUND OPENING
UNDERGROUND OPENING
(REVERSION)
EMPTY (AIR)
TERRAIN (SOIL)
(a)
(b)
(c)
A
B
C
Da
L1
L2
θi
θp

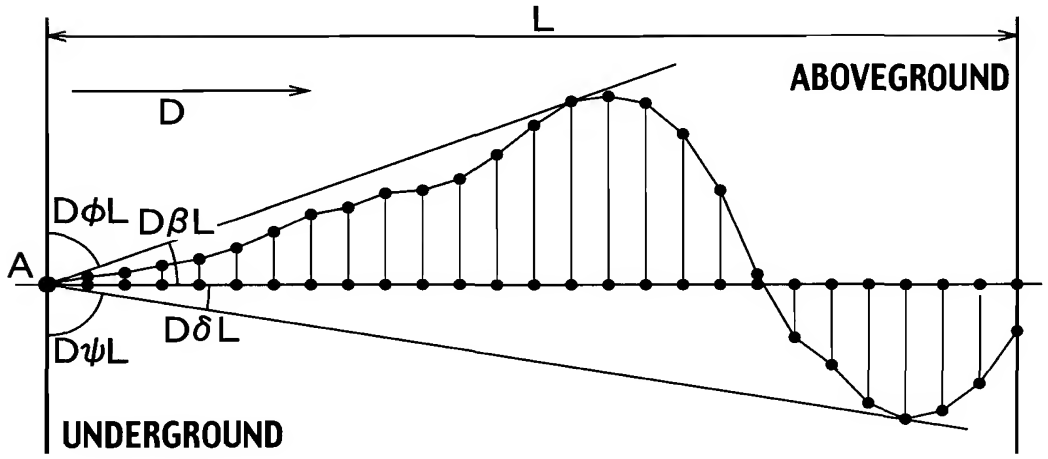
FIG.17

(a)



: ELEVATION ANGLE θ OF SAMPLE POINT A TO SAMPLE POINT B

(b)



: ABOVEGROUND ANGLE AND UNDERGROUND ANGLE OF D-L SET OF SAMPLE POINT A

FIG.18

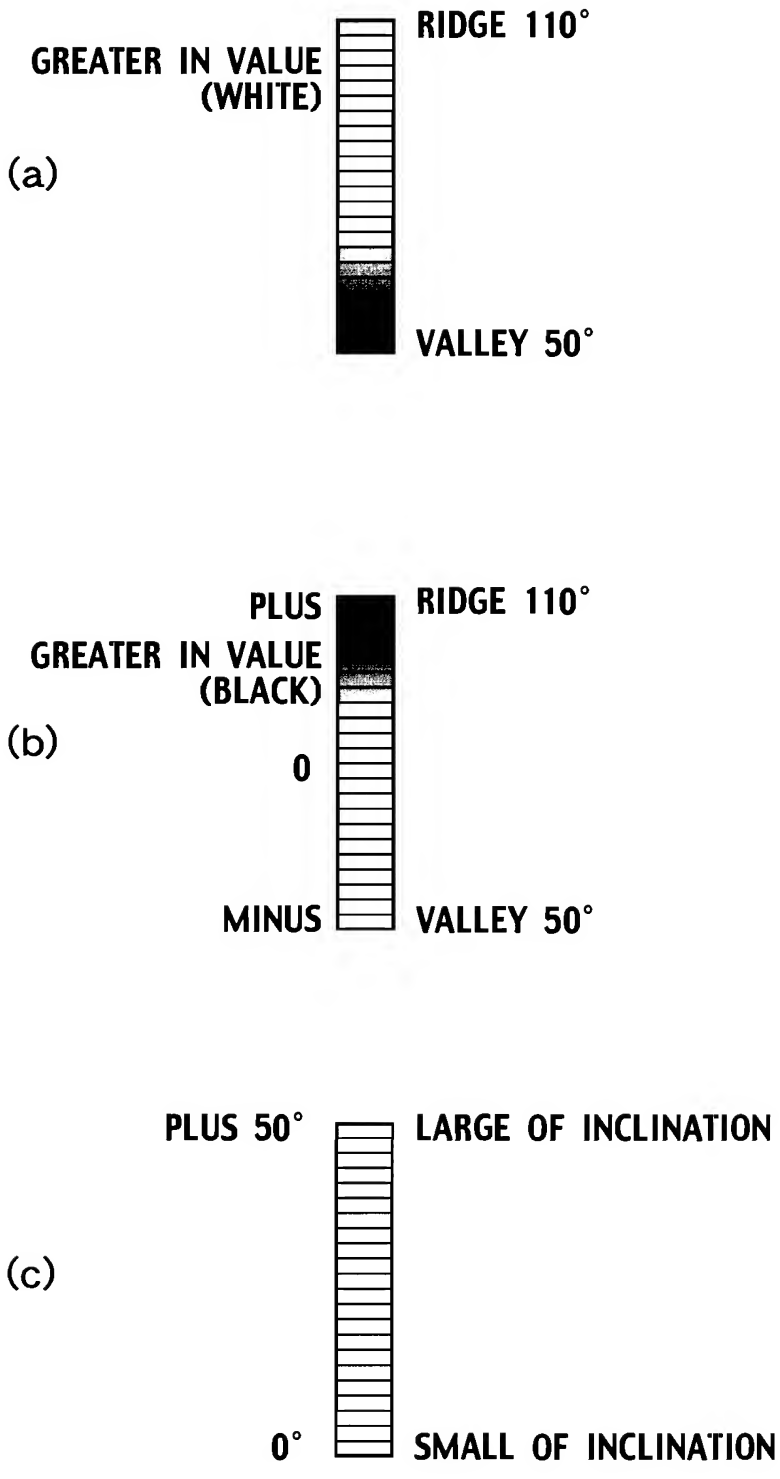

RIDGE 110°
GREATER IN VALUE
(WHITE)
(a)
VALLEY 50°
PLUS
RIDGE 110°
GREATER IN VALUE
(BLACK)
(b)
0
MINUS
VALLEY 50°
PLUS 50°
LARGE OF INCLINATION
(c)
0°
SMALL OF INCLINATION

FIG.19

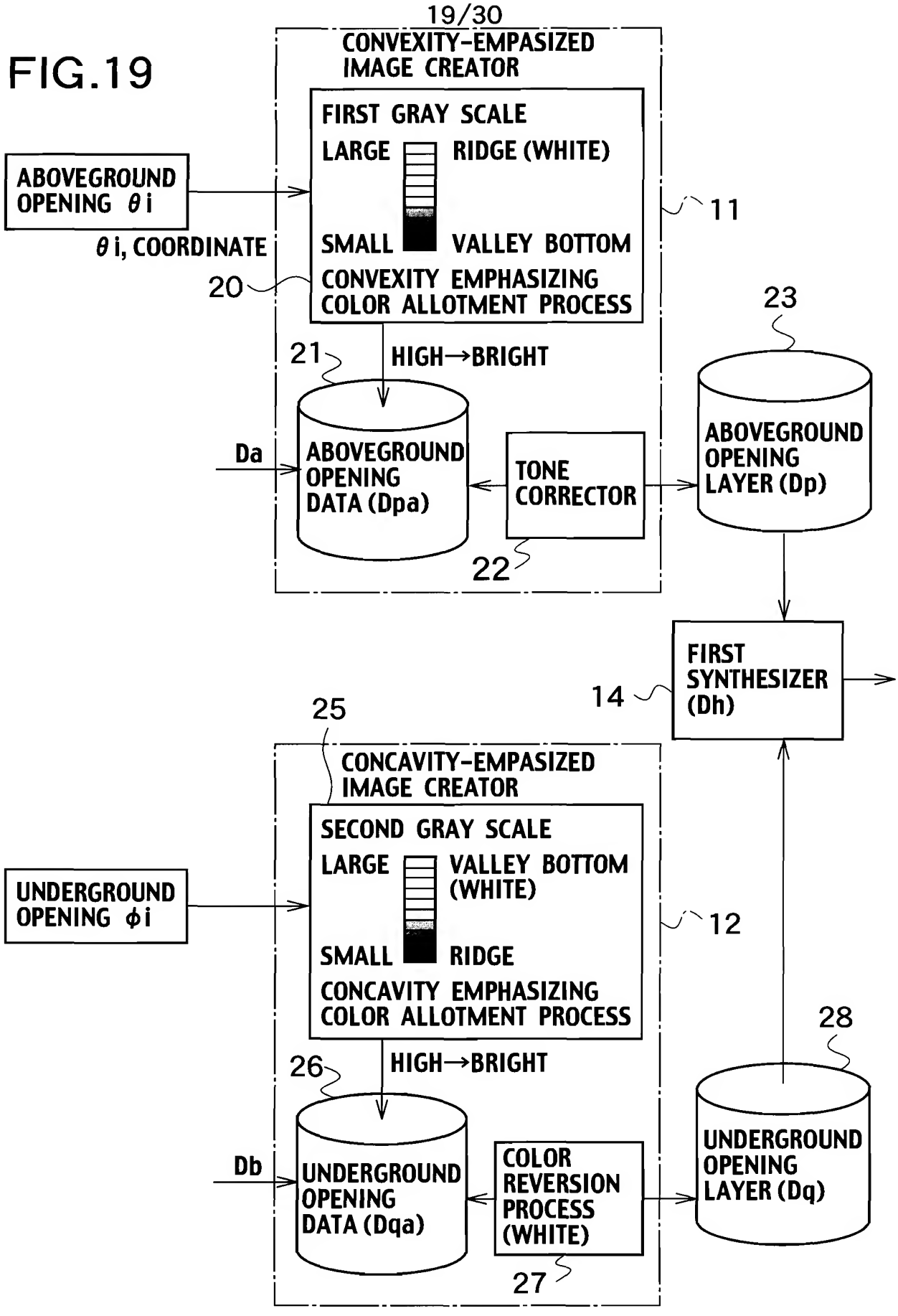

CONVEXITY-EMPASIZED IMAGE CREATOR
FIRST GRAY SCALE
LARGE
RIDGE (WHITE)
SMALL
VALLEY BOTTOM
CONVEXITY EMPHASIZING COLOR ALLOTMENT PROCESS
ABOVEGROUND OPENING θi
θi, COORDINATE
20
11
23
21
HIGH→BRIGHT
Da
ABOVEGROUND OPENING DATA (Dpa)
TONE CORRECTOR
ABOVEGROUND OPENING LAYER (Dp)
22
FIRST SYNTHESIZER (Dh)
14
25
CONCAVITY-EMPASIZED IMAGE CREATOR
SECOND GRAY SCALE
LARGE
VALLEY BOTTOM (WHITE)
SMALL
RIDGE
CONCAVITY EMPHASIZING COLOR ALLOTMENT PROCESS
UNDERGROUND OPENING φi
12
28
26
HIGH→BRIGHT
Db
UNDERGROUND OPENING DATA (Dqa)
COLOR REVERSION PROCESS (WHITE)
UNDERGROUND OPENING LAYER (Dq)
27

FIG.20

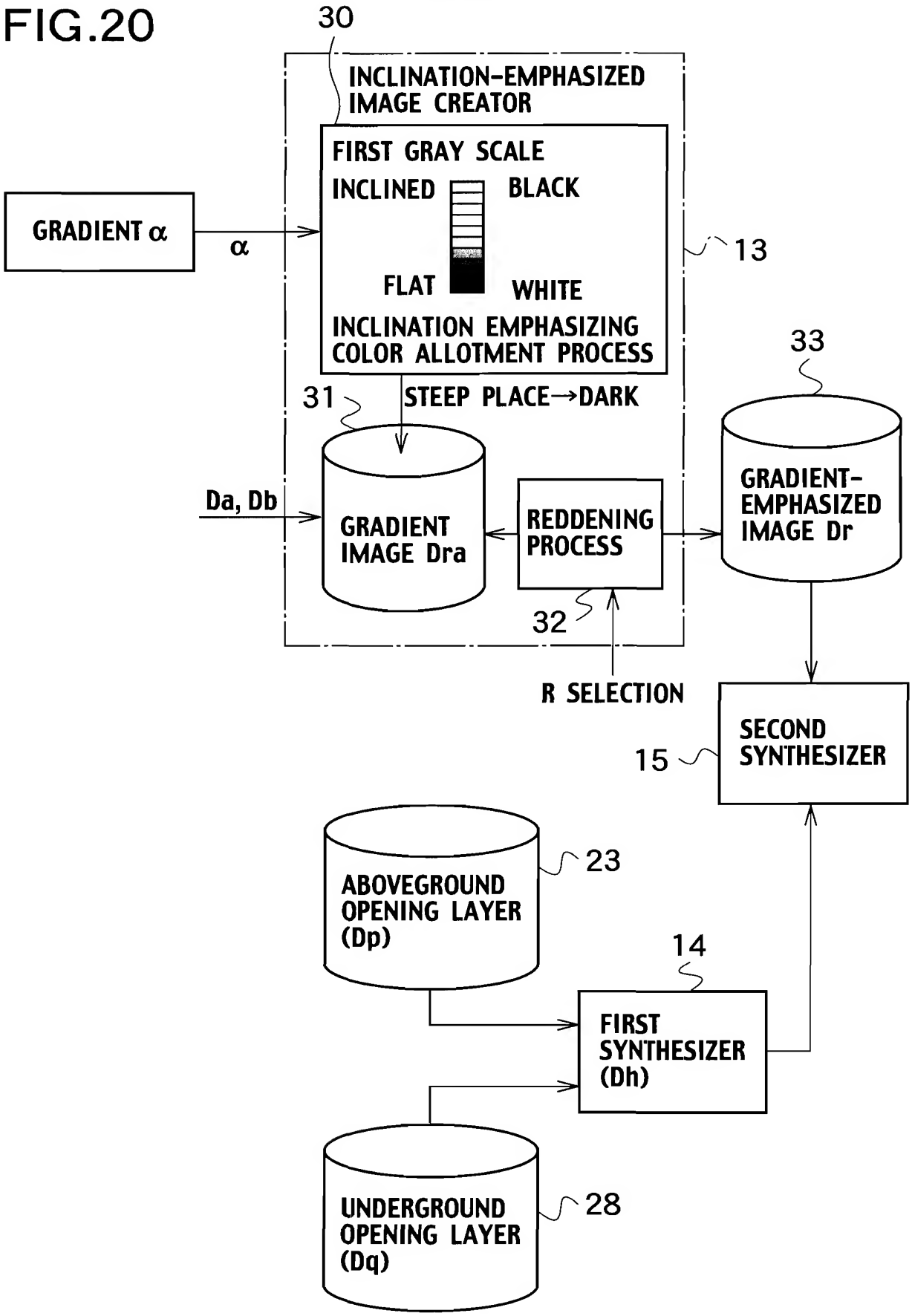

30
INCLINATION-EMPHASIZED IMAGE CREATOR
FIRST GRAY SCALE
INCLINED
BLACK
FLAT
WHITE
INCLINATION EMPHASIZING COLOR ALLOTMENT PROCESS
13
GRADIENT α
α
33
31
STEEP PLACE→DARK
Da, Db
GRADIENT IMAGE Dra
REDDENING PROCESS
GRADIENT-EMPHASIZED IMAGE Dr
32
R SELECTION
SECOND SYNTHESIZER
15
ABOVEGROUND OPENING LAYER (Dp)
23
14
FIRST SYNTHESIZER (Dh)
UNDERGROUND OPENING LAYER (Dq)
28

FIG.21

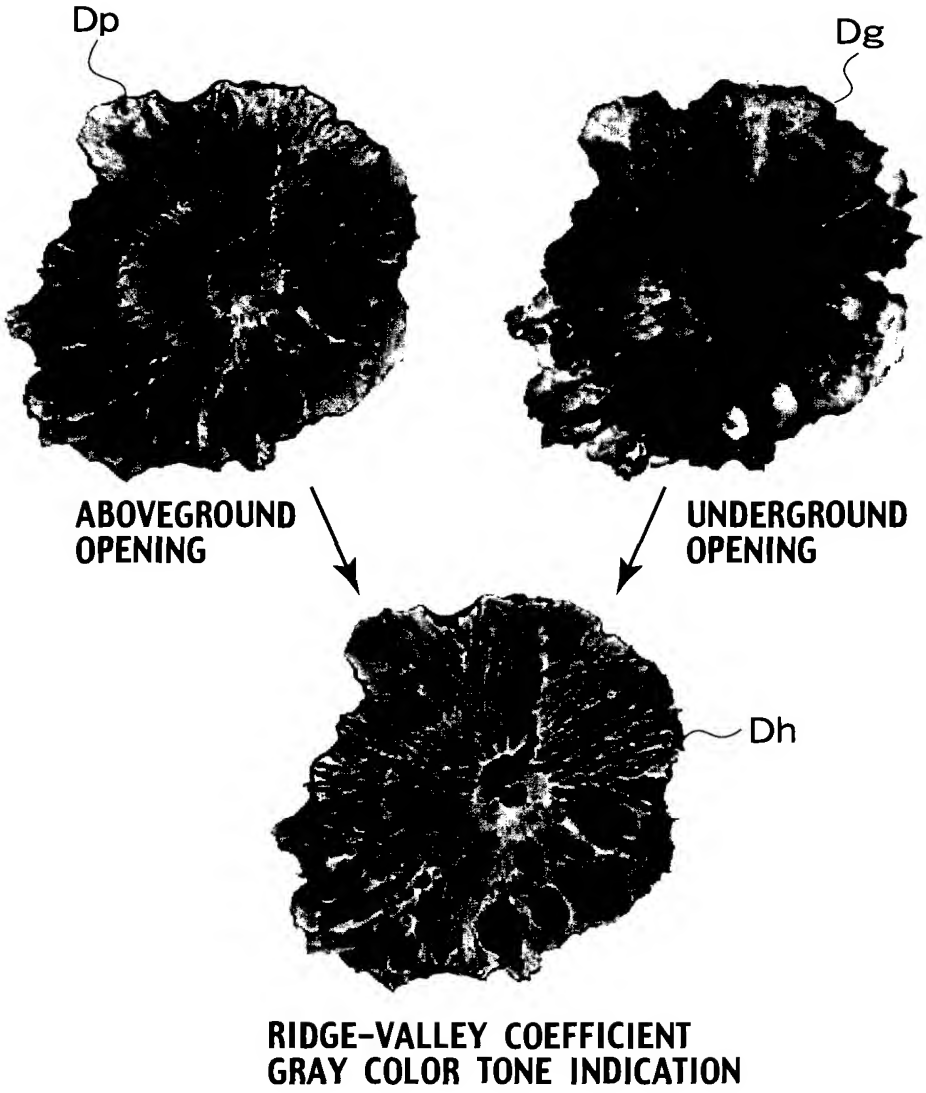

Dp
Dg
ABOVEGROUND OPENING
UNDERGROUND OPENING
Dh
RIDGE-VALLEY COEFFICIENT GRAY COLOR TONE INDICATION

FIG.22

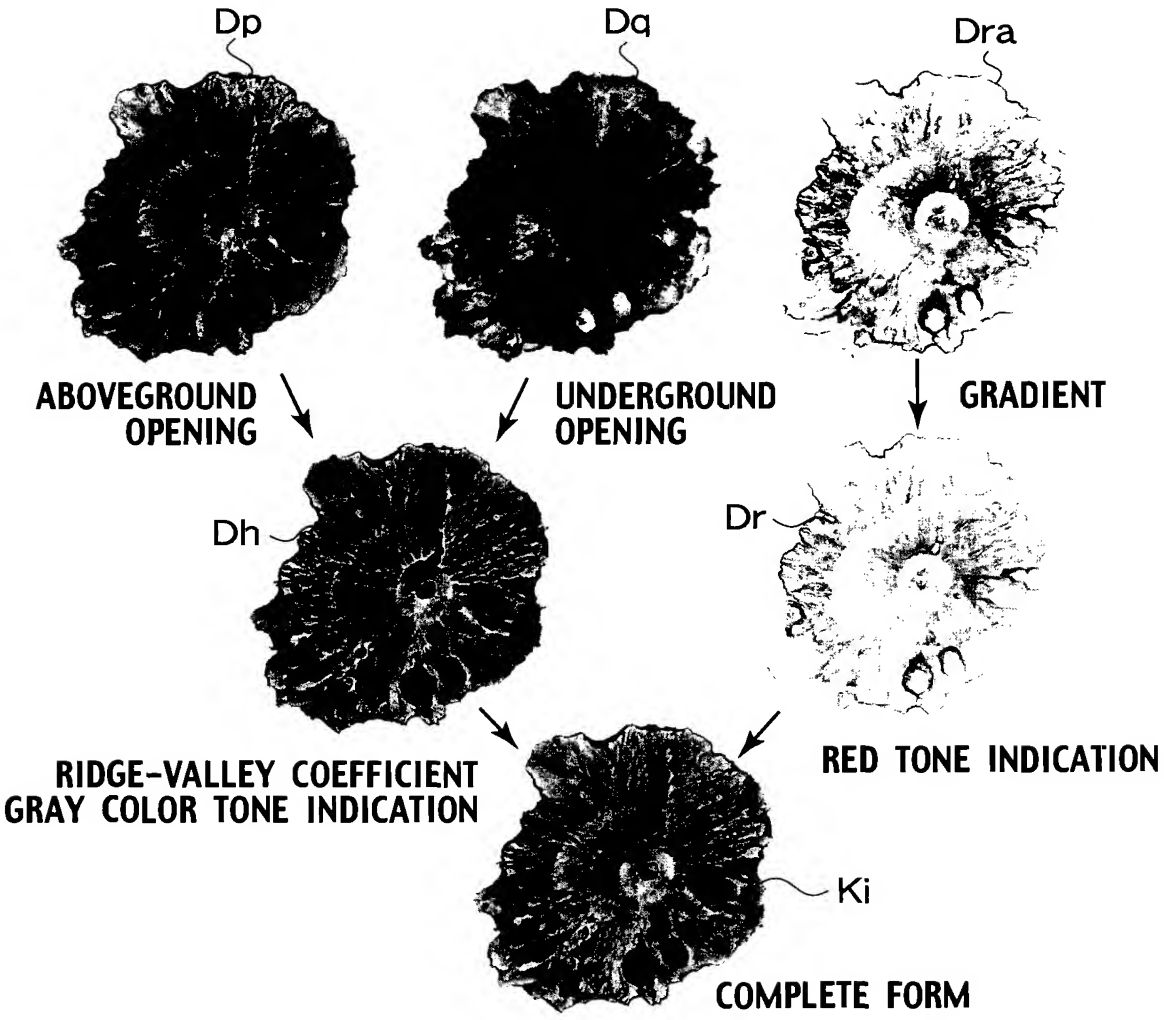
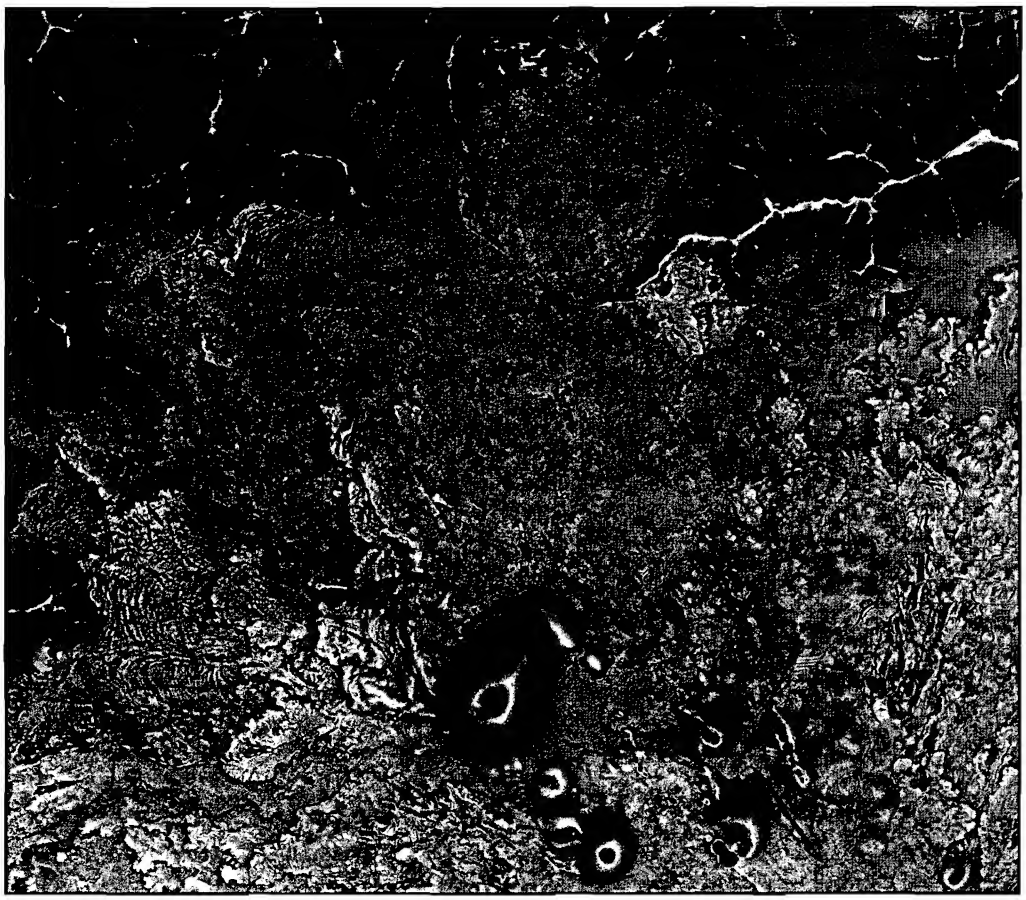
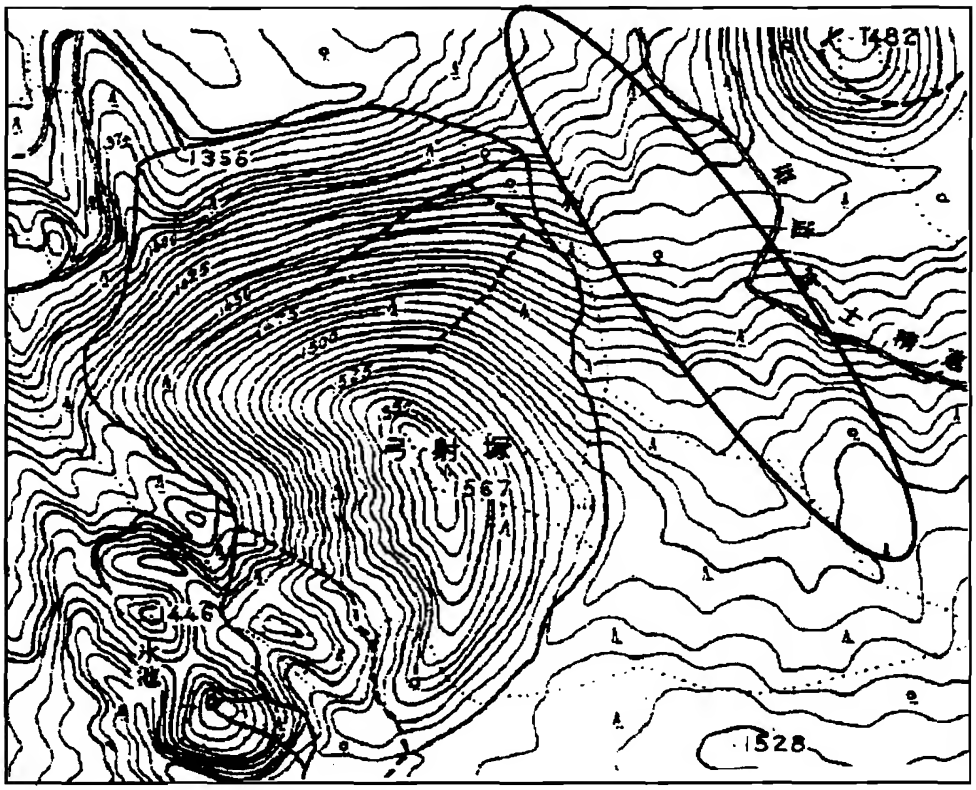

Dp
Dq
Dra
ABOVEGROUND OPENING
UNDERGROUND OPENING
GRADIENT
Dh
Dr
RIDGE-VALLEY COEFFICIENT GRAY COLOR TONE INDICATION
RED TONE INDICATION
Ki
COMPLETE FORM

FIG.23



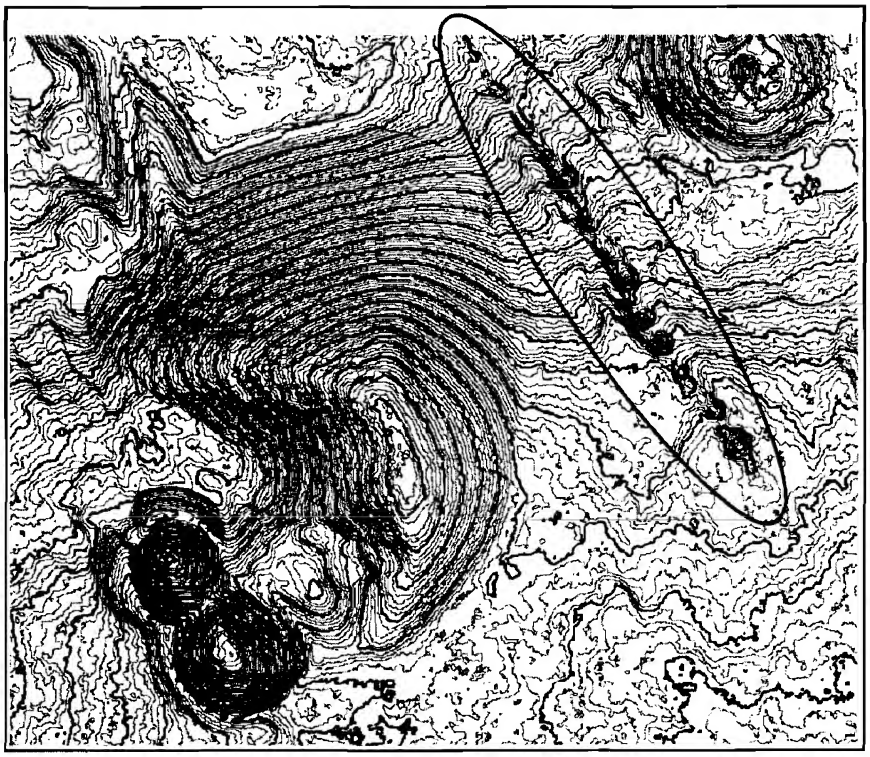
LASER STEREOSCOPIC IMAGE OF AOKIGAHARA LAVA FLOW DISTRIBUTION REGION

FIG.24



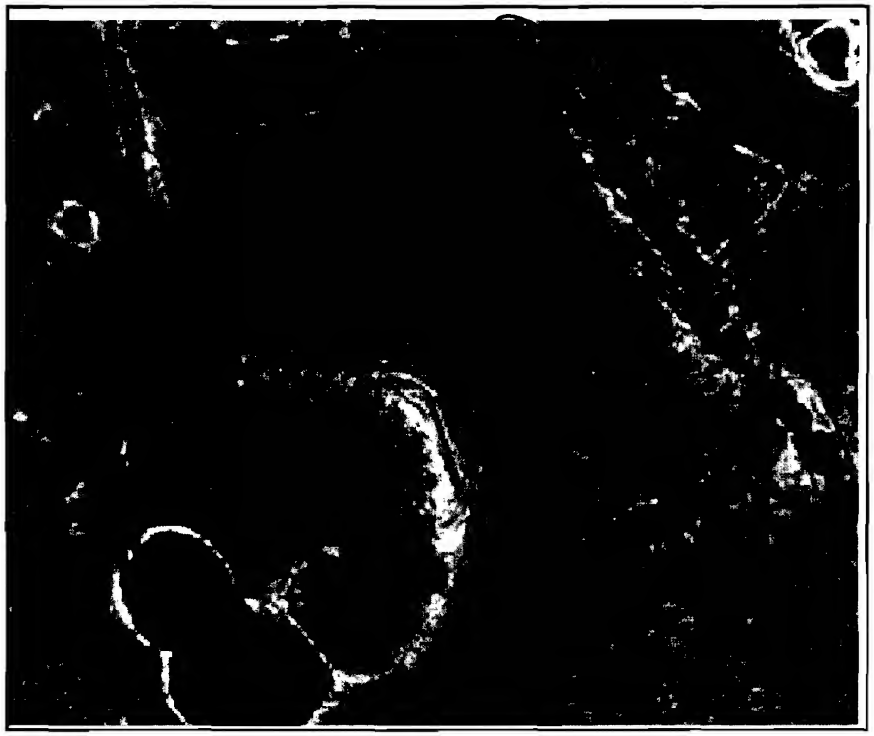
GEOGRAPHIC FEATURE BY AERIAL MAPPING MEASUREMENT WITH NO GLACIAL HOLE CRATER ROW INDICATED

FIG.25



LASER CONTOUR MAP

FIG.26



STEREOSCOPIC IMAGE

FIG.27

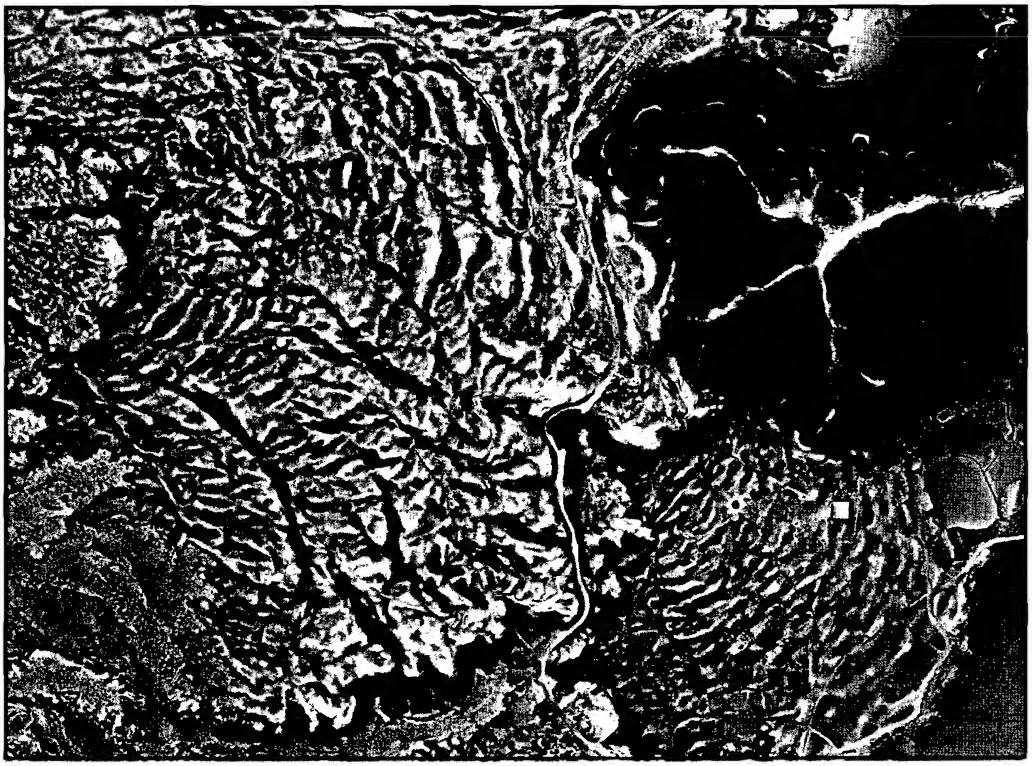


FIG.28

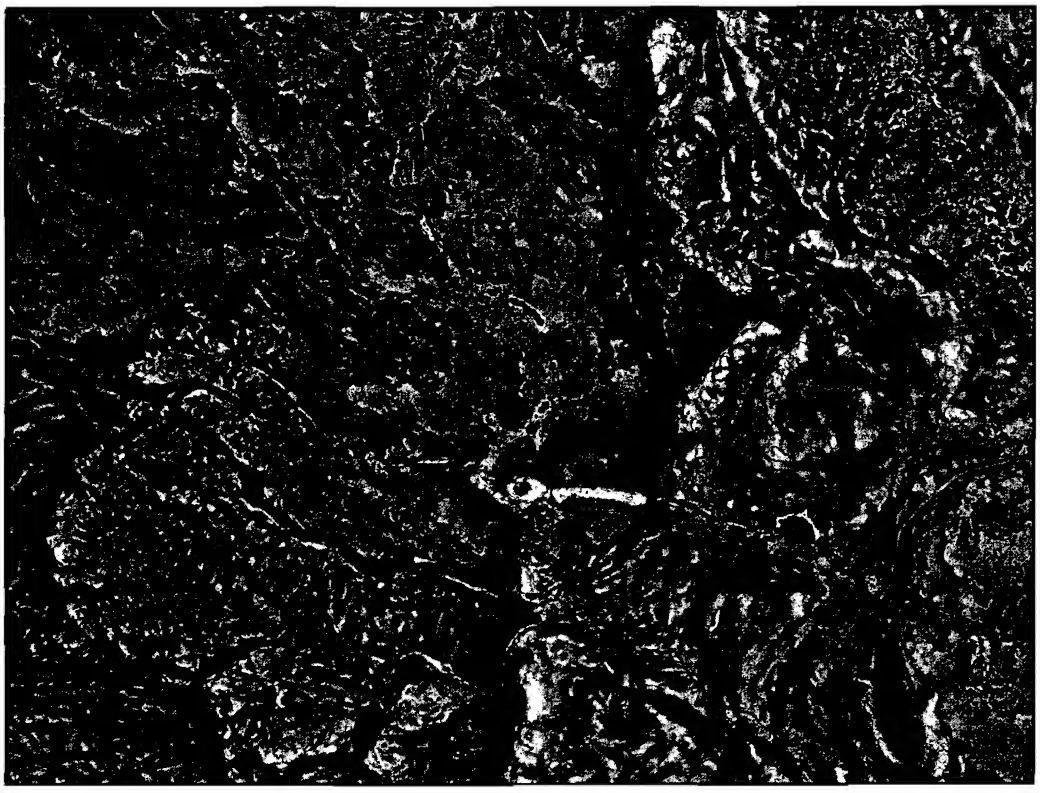


FIG.30

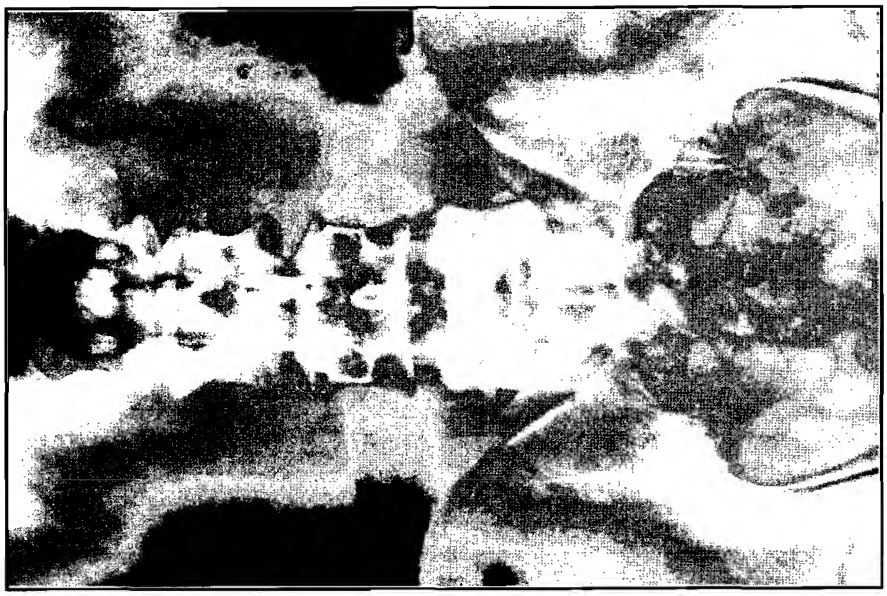


FIG.29

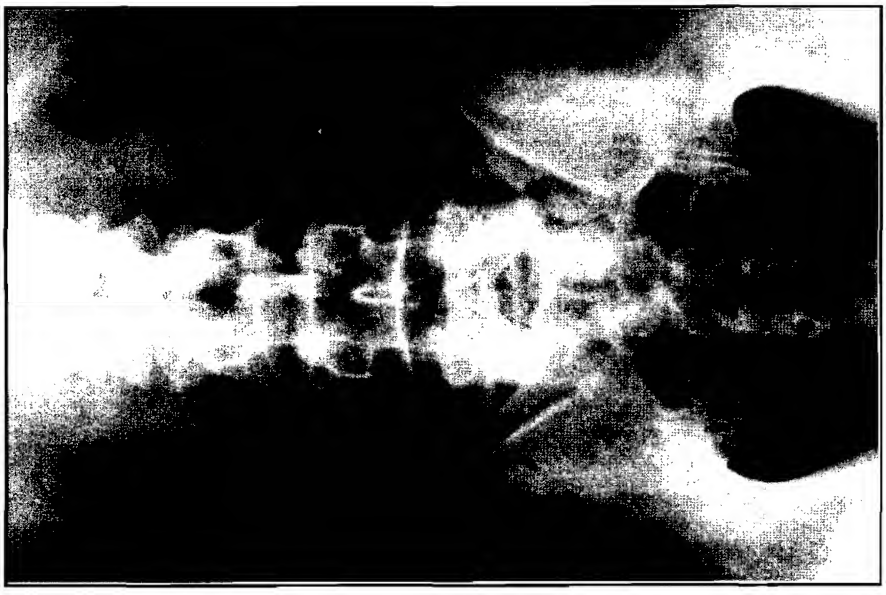


FIG.32

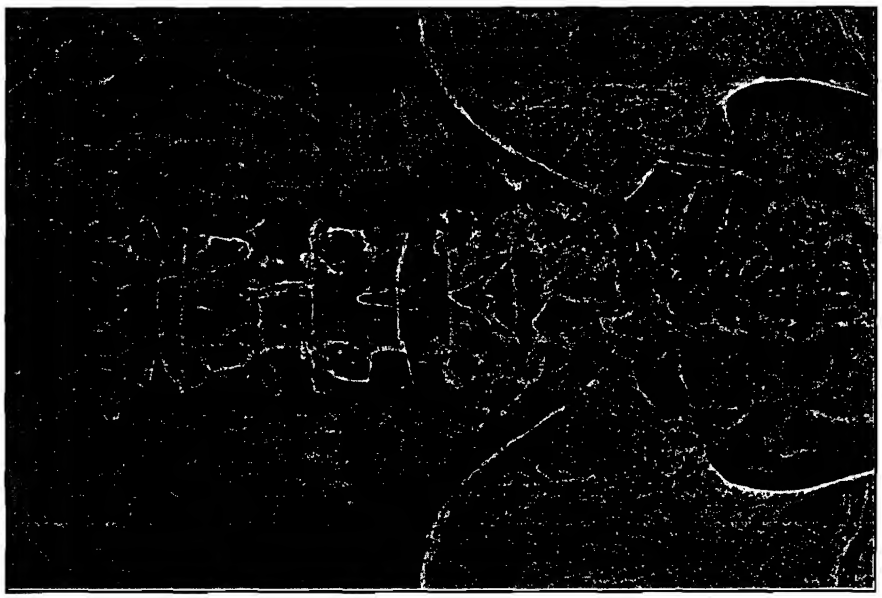


FIG.31